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4. TITLE AND SUBTITLE

A comparison of proximal tibia and proximal humerus infusion rates of plasma under high pressure using the EZ IO intraosseous device in the adult swine (Sus scrofa) hypovolemic model.

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5b. GRANT NUMBER

FWH20100171A

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

FWH20100171A

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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8. PERFORMING ORGANIZATION REPORT NUMBER

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12. DISTRIBUTION/AVAILABILITY STATEMENT

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

Purpose: Evaluate use of plasma admin via IO under pressure >300mmHg in proximal humerus and tibia, establish which IO sites reach higher flow rate, and eval for pulmonary fat emboli-FE post IO infusion. Method:2 groups of swine-16 each intubated and ventilated. Central venous and arterial lines placed; blood removed at rate of 2.15ml/min for 7min, then 1.15ml/min for 13min. Swine observed with no treatment for 1hr. EZIO needle inserted; plasma reinfused for 10min. Lung samples eval for signs of FE. Findings: The mean weight, vol removed and infusion pressure were similar in both groups. Mean vol plasma infused 490mL tibia and 649mL humerus. Mean infusion rate was 49mL/min(SD22mL/min) tibia and 78mL/min(SD43mL/min) humerus $p<0.02$. Survival rate 94% tibia, 88% humerus $p<0.33$. Humerus serum lactate elevated during 1hr post bleed; decreased post plasma infusion; tibia elevated until EOS. Histo revealed FE present 88% tibia, 94% humerus. Conclusion:IO infusion rate of plasma in humerus greater than tibia in swine model. Majority of swine had FE in lungs. Further studies needed to eval safety of high pressure infusion in IO device.

15. SUBJECT TERMS

plasma infusion, intraosseous infusion, IO, EZIO, intraosseous, resuscitation, swine, sus scrofa

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Vikhyat Bebarta, MD
U	U	U	SAR		19b. TELEPHONE NUMBER *(Include area code)* 210-275-3794

WHASC – Animal Final Report

17Oct2012

1. Protocol Number: FWH20100171A

2. Type of Research:
1) Animal Research

3. Title:
A comparison of proximal tibia and proximal humerus infusion rates of plasma under high pressure using the EZ IO intraosseous device in the adult swine (*Sus scrofa*) hypovolemic model.

4. Principal Investigator (PI):

Name	Rank	Date of IACUC Training	Branch of Service/ Corps	Staff Resident Fellow Civilian	Department / Office Symbol	Email (if other than WHASC Outlook)	Phone	Pager
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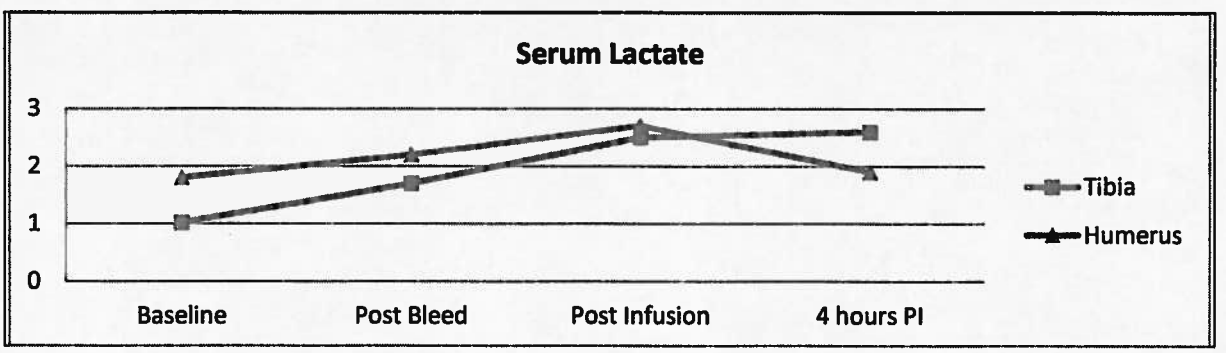
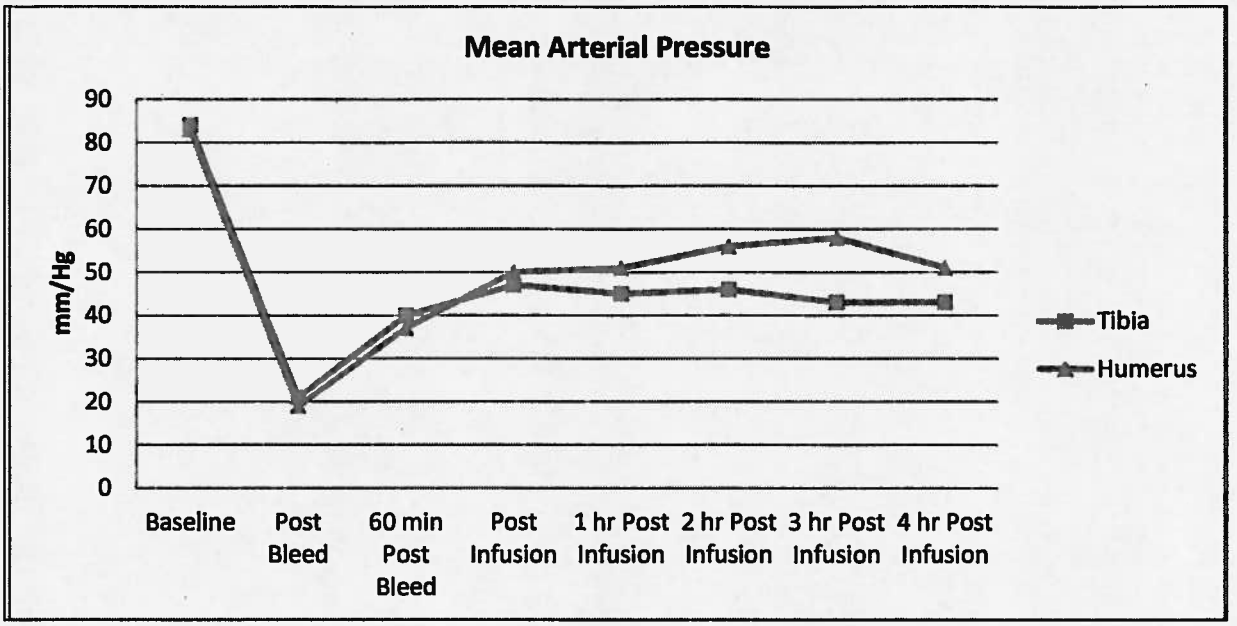
5. Purpose:
The purpose of this study is to evaluate the use of plasma product administration through an IO under pressures >300mmHg. A secondary objective of this study will be the establishment of which IO site between the proximal tibia, and proximal humerus can reach the higher flow rates. Data from Lairet et al. have postulated that the proximal humerus appears to deliver higher flow rates than the other site. This fact also needs to be validated. The study also evaluated the maximum pressure recorded during the infusion through the EZ IO needle in proximal tibia and proximal humerus as well as the presence or absence of pulmonary fat embolism after infusion of plasma through the IO device.

6. Results:
The mean weight of the animals was 70 Kg for the tibia arm and 68 Kg for the humerus arm. The mean volume removed for each group was 2108 mL in the tibia arm and 2050 mL in the humerus arm. The mean volume of plasma infused for each arm was 490 mL in the tibia arm and 649 mL in the humerus arm. The mean maximum infusion pressure was 616 mmHg (SD 32 mmHg) for the tibia and 607 mmHg (SD 24 mmHg) for the humerus $p<0.76$. The mean infusion rate for the tibia was 49 mL/min (SD 22 mL/min) and 78 mL/min (SD 43 mL/min) for the humerus $p < 0.02$. One of the animals in the tibia arm and 2 in the humerus arm died before completion of the experiment. The survival rate was 15/16 (94%) and 14/16 (88%) respectively $p<0.33$.

	Humerus	Tibia	Comparison
Rate of infusion	78 mL/min (SD 43)	49 mL/min (SD 22)	$p < 0.02$
Mean pressure	607 mmHg (SD 24)	616 mmHg (SD 32)	$p<0.76$



In the humerus arm the serum lactate increased during the hypovolemic period and decreased after infusion of plasma. In the tibia arm the serum lactate increased until the experiment ended.



Histopathologic examination revealed that fat emboli were present in 15/16 (%) of the tibia arm, 14/16 (%) of the humerus group.

Conclusion:

The rate of intraosseous infusion of plasma through the swine humerus was greater than the tibia in the swine model studied. Several number of studied animals revealed fat emboli in the lungs. Further studies are needed to evaluate the safety of high pressure infusions through an IO device.

7. How may your findings benefit the Air Force?

The results of this study suggest that the humerus may be a better site for administration through an intraosseous device. The fact that fat emboli were seen in the lungs needs to be further studied as this finding if confirmed would suggest that intraosseous devices might only be used in emergency situations.

8. Number of Animals

Projected Enrollment of Animals at the Beginning of Study: **36**
Actual Number of Animals Enrolled: **34**

9. Status of Animals Entered Into the Protocol:

All animals were in good general health and were euthanized per protocol.

10. Status of Funds:

All funds were executed.

11. Reason for Closure:

Objectives of the study were met. Dr. Lairet was PI for the execution of the study and Dr. Bebarta assumed PI when Dr. Lairet separated from the military in May 2012.

12. Specific Problems:

No issues were encountered.

13. Publications and Presentations:

Presentations:

Poster presentation at MHSRS/ATACCC August 2012.

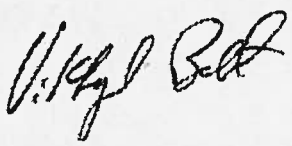
Publications:

None

14. Exceptional Achievements:

None

15. Signature of Principal Investigator:



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